

Appl. No.: 09/823,437

Amdt. dated: February 26, 2004

Reply dated: August 17, 2004

Amendments to the Claims:

This listing of the claims will replace all previous listings of the claims for this application.

IN THE CLAIMS:

1(canceled). A method of summarizing video including a slow motion replay comprising:

- (a) analyzing of said video for said slow motion replay; and
- (b) summarizing said video based upon said analyzing.

2(new). A method of summarizing video depicting an event comprising:

- (a) detecting a plurality of slow motion relay segment within said video depicting said event;
- (b) summarizing said video by including said plurality of slow motion replay segments in a summarization, wherein said summarization is less than said video.

3(new). The method of claim 2 wherein said summarization is provided to a user.

4(new). The method of claim 3 wherein the duration of said summarization is based upon the preferences of said user.

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5(new). The method of claim 3 wherein the duration of said summarization is based upon the usage conditions of said summarization.

6(new). The method of claim 3 wherein the duration of said summarization is based upon the system resources of the user.

7(new). The method of claim 2 wherein said summarization has fewer frames than said video.

8(new). The method of claim 2 wherein said summarization depicts sections of said video comprising the said summarization.

9(new). A method of determining the boundary of a slow motion replay of an event in a video comprising:

- (a) determining statistical measure of different portions of said video that include said event and said slow motion replay of said event;
- (b) based upon said statistical measure determining said boundary of said slow motion replay of said event.

10(new). The method of claim 9 wherein said statistical measure includes a Hidden Markov

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Model.

- 11(new). The method of claim 10 wherein said statistical measure includes a state.
- 12(new). The method of claim 11 wherein said boundary is based upon the change of said state to another state.
- 13(new). A method of training a statistical model for video comprising:
- (a) providing video data that includes an event and a slow motion replay of said event to said statistical model;
 - (b) training said statistical model based upon said video to improve the likelihood of identifying slow motion replay segments in other video.
- 14(new). The method of claim 13 wherein said statistical model is a Hidden Markov Model.
- 15(new). The method of claim 14 wherein said model includes a plurality of states.
- 16(new). A method of identifying a slow motion replay of an event in a video comprising:
- (a) identifying a first effect included within said video that is not a natural event;

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- (b) identifying a second effect included within said video that is not a natural event;
- (c) classifying a portion of the time between said first effect and said second effect as being said slow motion replay of said event.

17(new). The method of claim 16 wherein said event is a sporting activity.

18(new). The method of claim 16 wherein said video contains primarily sports.

19(new). The method of claim 16 wherein said slow motion replay is a sporting activity.

20(new). A method of identifying a sequence in a video comprising:

- (a) identifying an action segment characterized by relatively fast moving objects;
- (b) identifying a first effect included within said video that is not a natural event, said first effect temporally later than said action segment;
- (c) identifying a slow motion replay of said action segment, said slow motion replay temporally later than said first effect;
- (d) identifying a second effect included within said video that is not a natural event, said second effect temporally later than said slow motion replay, wherein said action segment, said first effect, said second effect, and said slow motion replay are identified free from a user having to manually identify any of said action

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segment, said first effect, said second effect, and said slow motion replay.

21(new). The method of claim 20 wherein said identifying of steps (a), (b), (c), and (d) are based upon a statistical model.

22(new). The method of claim 20 wherein said video includes sporting activity.

23(new). A method of identifying a slow motion replay of an event in a video comprising:

- (a) identifying a first effect included within said video that is not a natural event;
- (b) identifying a first plurality of still fields within said video, said still fields temporally later than said first effect;
- (c) identifying an intermediate segment, said intermediate segment temporally later than said first plurality of still fields;
- (d) identifying a second plurality of still fields within said video, said still fields temporally later than said intermediate segment;
- (e) identifying a second effect included within said video that is not a natural event, said second effect temporally later than said second plurality of still fields;
- (f) wherein said intermediate segment, said first effect, said second effect, said first and second plurality of still fields are identified free from a user having to manually identify any of said intermediate segment, said first effect, said second

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effect, said first and second plurality of still fields.

24(new). The method of claim 23 wherein said identifying of steps (a), (b), (c), (d), and (e) are based upon a statistical model.

25(new). The method of claim 23 wherein said video includes sporting activity.

26(new). A method of analyzing video comprising:

- (a) detecting a plurality of slow motion segments within said video;
- (b) characterizing at least one of said slow motion segments as a commercial and characterizing at least another of said slow motion segments as not a commercial.

27(new). The method of claim 26 further comprising summarizing said video by including said plurality of slow motion replay segments in a summarization, wherein said summarization is less than said video.

28(new). The method of claim 26 wherein said another of said slow motion segments is a replay segment.

29(new). The method of claim 28 wherein said video is a sporting activity.

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- 30(new). A system for summarizing video comprising:
- (a) a feature extractor;
 - (b) a probabilistic model that identifies potential slow motion replay segments provided by said feature extractor;
 - (c) a filter distinguishing commercials from non-commercial of said potential slow motion replay segments; and
 - (d) a summary generator summarizing said video by including said plurality of slow motion replay segments in a summarization, wherein said summarization is less than said video.
- 31(new). The system of claim 30 wherein said feature extractor includes a histogram.
- 32(new). The system of claim 31 wherein said histogram is color.
- 33(new). The system of claim 30 wherein said feature extractor uses pixel-based differences.
- 34(new). The system of claim 30 wherein said feature extractor is free from using motion vectors.

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35(new). The system of claim 30 wherein said feature extractor characterizes slow motion segments, still field segments, and normal-play segments of said video.

36(new). The system of claim 30 wherein said feature extractor includes a sliding window and characterizes the number of zero-crossings within said sliding window.

37(new). The system of claim 33 wherein said differences is based upon the mean order-p luminance difference as follows:

$$D(t) = \min \left(\frac{1}{NM} \sum_{n,m} |I(n, m, t) - I(n, m, t-1)|^p, \frac{1}{NM} \sum_{n,m} |I(n-1, m, t) - I(n, m, t-1)|^p, \frac{1}{NM} \sum_{n,m} |I(n+1, m, t) - I(n, m, t-1)|^p \right)$$

where $I(n, m, t)$ is the luminance intensity at (n, m) at time t , p is the order, and N and M are the vertical and horizontal resolutions, respectively.

38(new). A method of identifying the boundaries of a candidate slow motion segment of a video comprising:

- (a) using a non-Hidden Markov Model technique to determine a frame in said

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candidate slow motion segment;

- (b) using a Hidden Markov Model technique to identify said boundaries of said candidate slow motion segment.

39(new). The method of claim 38 wherein said identify said boundaries are using forward and backward Hidden Markov Model techniques.

40(new). A method of identifying a slow motion segment in a video using a probabilistic model comprising:

- (a) receiving said video that includes a candidate slow motion segment;
- (b) processing said video using said probabilistic model using a Hidden Markov Model that includes at least five components, wherein said components include:
 - (i) a preprocessor that converts features in a range suitable for a forward Hidden Markov Model and a backward Hidden Markov Model;
 - (ii) a one-point detector identifying at least one frame in said candidate slow motion segment;
 - (iii) said forward Hidden Markov Model processing said video;
 - (iv) said backward Hidden Markov Model processing said video;
 - (v) a post processor that filters the results of steps (iii) and (iv).

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